WASHING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a washing machine, and more particularly, to a washing machine including a balancer formed at a lower part of a washing tub in order to reduce vibration generated during rotation of the washing tub.

2. Description of the Background Art

Generally, as shown in Figure 1, a washing machine includes a case 110 forming an exterior of a washing machine and whose upper part is selectively opened, an outer tub 112 disposed in the case 110 and filled with water, an inner tub 114 disposed in the outer tub 112 to receive laundry and rotated to wash and dewater the laundry, a washing plate 116 installed inside the inner tub 114 and rotated to agitate water and the laundry, a hollow dewatering shaft 118 coupled to the inner tub 114 so as to be integrally rotated with the inner tub 114, a washing shaft 120 received in the dewatering shaft 118, connected to the washing plate 116 and independently rotated with respect to the dewatering shaft 118 to rotate the washing plate 116, a driving motor 122 for providing a driving force to rotate the dewatering shaft 188 and the washing shaft 120, and an upper balancer 124 installed at an upper part of the inner tub 114 and reducing vibration generated during rotation of the inner tub 114.

In the washing machine according to the conventional art, as the driving

motor operates, the washing plate 116 is rotated to wash the laundry received in the inner tub 114. When the washing operation is finished, the washing plate 116 and the inner tub 114 are integrally rotated for dewatering.

However, in the washing machine according to the conventional art, vibration is generated during dewatering due to the high-speed rotation of the inner tub 114 having the laundry therein. The vibration is absorbed to a degree by the upper balancer 124, but in case that the lower part of the inner tub 114 is unbalanced, the degree of vibration becomes very strong. Then, performance of the washing machine is deteriorated due to the vibration of the lower part of the inner tub 114.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide a washing machine in which a balancer is installed at a lower part of an inner tub in order to effectively reduce vibration generated by rotation of an inner tub.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a washing machine including an outer tub disposed in a case and receiving water therein, an inner tub installed in the outer tub, receiving laundry therein and rotated for washing and dewatering the laundry and a lower balancer installed at a lower part of the inner tub for reducing vibration generated during rotation of the inner tub.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed

description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a unit of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

Figure 1 is a sectional view showing a washing machine according to the conventional art;

Figure 2 is a sectional view showing a washing machine according to the first embodiment of the present invention;

Figure 3 is a perspective view showing a lower balancer of the washing machine according to the first embodiment of the present invention;

Figure 4 is a sectional view taken along line IV-IV of Figure 3;

Figure 5 is a perspective view showing a lower balancer of the washing machine according to the first embodiment of the present invention;

Figure 6 is a perspective view showing a lower balancer of the washing machine according to the first embodiment of the present invention;

Figure 7 is a sectional view showing a lower balancer of the washing machine according to the first embodiment of the present invention;

Figure 8 is a sectional view showing a lower balancer of the washing machine according to the first embodiment of the present invention;

Figure 9 is a sectional view showing a lower balancer of the washing machine according to the first embodiment of the present invention;

Figure 10 is a longitudinal sectional view showing a washing machine according to the second embodiment of the present invention; and

Figure 11 is a longitudinal sectional view showing a washing machine according to the third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

Figure 2 is a longitudinal sectional view showing a washing machine according to the first embodiment of the present invention.

The washing machine according to the first embodiment of the present invention includes a case 10 forming an exterior of the washing machine and whose upper part is selectively opened, an outer tub 12 disposed in the case 10 and being filled its inside with water, an inner tub 14 disposed in the outer tub 12 to receive laundry and rotating to wash and dewater the laundry, a washing plate 16 installed inside of the inner tub 14 and rotated to agitate water and the laundry, a hollow dewatering shaft 18 connected to the inner tub 14 so as to be integrally rotated with the inner tub 14, a washing shaft 20 received in the dewatering shaft 18, connected to the washing plate 16 and independently rotated with respect to the dewatering shaft 18 to rotate the washing plate, a driving motor 22 for providing a driving force to rotate the dewatering shaft 18

and the washing shaft 20, an upper balancer 24 installed at an upper part of the inner tub 14 and reducing vibration generated during rotation of the tub 14, and a lower balancer installed at a lower part of the inner tub 14 and preventing the lower part of the inner tub 14 from unbalancing during the rotation of the inner tub 14.

The upper balancer 24 is installed at an inner circumferential surface of the upper part of the inner tub 14 and filled with a fluid for preventing the upper part of the inner tub 14 from unbalancing during rotation of the inner tub 14.

As shown in the Figures 3 and 4, the lower balancer 80 includes a base plate 90 installed at the outer circumferential surface of the lower part of the inner tub 14 and providing a space for filling a fluid between the lower outer surface of the inner tub and the base plate 90; and a plurality of partition walls 86 radially installed at certain intervals inside of the base plate 90, dividing the filling space into a plurality of sections, and having a flow path through which the fluid filled in each section can pass. Salt water is generally used as a fluid filling the lower balancer 80, and other kinds of fluids also can be used.

The base plate 90 includes a hollow disc unit 83, an outer wall 81 extended from an outer circumference of the disc unit 83 and tightly fixed at the lower circumferential surface of the inner tub 14, and an inner wall 82 extended from an inner circumference of the disc unit 83 and tightly fixed at the lower surface of the inner tub 14. Herein, preferably, the disc unit 83 of the base plate 90 is formed in a curved surface according to the lower part of the outer circumferential surface of the inner tub 14, in consideration of disposition of the other parts of the washing machine.

In addition, a reinforcing rib 88 is formed inside the base plate 90 in a

circumferential direction to divide the partition wall 86 into an inner partition wall 84 and an outer partition wall 85, so as to increase rigidity of the lower balancer 80 and the number of the filling spaces.

The flow path 87 formed at the outer partition wall 85 has a groove form with a certain width and depth. As shown in Figure 5, a flow path 94 allowing the fluid in each filling space to pass is formed by sloping down the inner partition wall 84 toward the center of the base plate 90 at a certain angle.

Also, as shown in Figures 6 to 8, flow paths 95 and 97 can be formed by disposing the inner partition wall 84 with a certain interval from the inner wall 82 or the reinforcing rib 88. Further, flow paths 96 and 98 can be formed by disposing the outer partition wall 85 with a certain interval from the outer wall 81 or the reinforcing rib 88.

The base plate 90 may be directly fixed at the lower surface of the inner tub 14. As shown in Figure 9, however, a cover 91 may be installed at an upper portion of the base plate 90, in other words, between a lower outer surface of the inner tub 14 and the base plate 90.

Operation of the washing machine according to the first embodiment of the present invention will now be described.

During washing, when the driving motor 22 operates, the washing shaft 20 connected to the driving motor 22 is rotated. By the rotation of the washing shaft 20, the washing plate 16 installed in the inner tub 14 is rotated to agitate the laundry and water in the inner tub 14, and thus, the laundry is washed by friction between the laundry and the water.

When the washing operation of the washing machine is finished, water in the outer tub 12 is drained, and then, when the driving motor 22 is rotated,

the dewatering shaft 18 connected to the driving motor 22 is rotated.

According to the rotation of the dewatering shaft 18, the inner tub 14 is rotated at a high-speed to generate a centrifugal force. Accordingly, water contained at the laundry is discharged toward the outer tub 12.

At this time, a balance of the upper part of the inner tub 14 is maintained by the upper balancer 24 installed at the upper part of the inter tub 14, and particularly, vibration of the inner tub 14 is prevented by the lower balancer 80 installed at the lower part of the inner tub 14.

That is, when the inner tub 14 is tilted by the rotation, a fluid filled between partition walls 86 of the base plate 90 in the lower balancer 80 flows through the flow path 89 in an opposite direction to a lopsided direction of the inner tub 14 thereby preventing the inner tub from unbalancing. Therefore, the vibration of the inner tub 14 can be prevented. Also, the unbalance of the inner tub 14 can be prevented in advance because the center of gravity of the inner tub 14 is moved to a lower part of the inner tub 14 by the lower balancer 80.

The lower balancer 80 can achieve the effect while the inner tub 14 is rotated at a high speed for dewatering and even at a low speed for washing. A position of the lower balancer 80 is not limited by an installation position described in The first embodiment of the present invention, and can be applied at various positions according to a form of washing machine.

In the washing machine according to the first embodiment of the present invention, the balancers are installed at both upper and lower parts of the inner tub to prevent the inner tub from tilting to the one side. Accordingly, vibration generated during washing and high-speed dewatering of the washing machine can be significantly reduced. Also, the unbalance of the inner tub can

be prevented in advance because the center of gravity of the inner tub moves to the lower part by installing the weighty lower balancer at the lower part of the inner tub. In addition, the lower balancer is installed at the lower part of the inner tub, so that a dead volume between the inner tub and the outer tub can be utilized, and because the lower balancer has a certain volume, water and detergent can be reduced as much, and washing time can be reduced as the water supply time is shorten.

A washing machine according to the second embodiment of the present invention will now be described.

Figure 10 is a longitudinal sectional view showing a washing machine according to the second embodiment of the present invention.

A washing machine according to the second embodiment of the present invention includes a cylindrical outer tub 212 disposed in a case, an inner tub 214 installed in the outer tub 212 such that its central axis is eccentric with that of the outer tub 212, a washing plate 216 installed at an inner lower portion of the inner tub 214 and coaxially rotated with the inner tub 214, a hollow dewatering shaft 218 connected to the inner tub 214 and rotated coaxially with the central axis of the outer tub 212, a washing shaft 220 received in the dewatering shaft 218 and making an independent rotation to the dewatering shaft 218, an eccentric shaft 226 installed at the upper part of the washing shaft 220 so as to be eccentric with the center of the washing shaft 220, coaxially connected with the washing plate 216 so as to orbit together with the washing plate 216 centering around the washing shaft 220, a counter weight 228 eccentrically installed at the upper part of the washing shaft 220 at an opposite directional position to a position at which the eccentric shaft 226 is installed, so

as to compensate a lopsided eccentric weight when the inner tub 214 and the washing plate 216 are rotated centering around the dewatering shaft 218 and the washing shaft 220, a driving motor 222 for providing a driving force to rotate the dewatering shaft 218 and the washing shaft 220, a clutch 230 making the dewatering shaft 218 and the washing shaft 220 to be engaged and integrally rotatable, and releasing the dewatering shaft 218 and the washing shaft 220 so as to make only the washing shaft 220 rotatable, an upper balancer 224 installed at the upper part of the inner tub 214 for reducing vibration generated during rotation of the inner tub 214, and a lower balancer 280 installed at the lower part of the inner tub 214 to prevent the lower part of the inner tub 214 from unbalancing, and thus, reducing vibration generated during a rotation of the inner tub 214.

Herein, the lower balancer 280 has the same construction as described in the first embodiment of the present invention.

The operation of a washing machine according to the second embodiment of the present invention will now be described.

First, for a washing operation, when a driving force of the driving motor 222 is transmitted to the washing shaft 220, the eccentric shaft 226 installed to be eccentric with the washing shaft 220 and the counter weight 228 orbit centering the washing shaft 220. At this time, the washing plate 216 slides on the bottom of the inner tub 214, orbiting centering around the washing shaft 220 so that the laundry can be washed by a continuous agitation. Herein, an unbalance of the washing plate 216 is compensated by the counter weight 228.

When the washing operation is finished, dewatering is started and water in the outer tub 212 is drained out. That is, the dewatering shaft 218 and the

washing shaft 220 are engaged with each other by the clutch 230 and, when the driving motor 222 is rotated, the dewatering shaft 218 connected to the driving motor 222 and the washing shaft 220 are integrally rotated. The inner tub 214 is rotated by rotation of the dewatering shaft 218, being eccentric with the center of the dewatering shaft 218, and thus, water contained in the laundry is discharged toward the outer tub 212 by a centrifugal force.

At this time, when the inner tub 214 is rotated, it may be lopsided and a vibration may occur during rotation of the inner tub 214 because the inner tub is rotated, being eccentric with the center of the dewatering shaft 218. However, the lopsidedness and the vibration of the inner tub 214 are prevented by performance of the lower balancer 280 installed at the surface of the inner tub 214. Herein, the performance of the lower balancer is the same as described in the first embodiment of the present invention.

In the washing machine according to the second embodiment of the present invention, the balancer is installed at the upper part of the inner tub and at the lower part of the inner tub as well, to prevent the inner tub from being lopsided when the inner tub is rotated. Accordingly, vibration generated during washing operation and high speed dewatering can be remarkably reduced. Particularly, in the case of the vibration-type washing machine in which the outer tub, the inner tub, the washing plate, the washing shaft and the dewatering shaft are not positioned coaxially according to The second embodiment of the present invention, the inner tub could be easily lopsided and vibrate. But the vibration of the inner tub is prevented by installing the lower balancer at the lower part of the inner tub.

A washing machine according to the third embodiment of the present

invention will now be described.

Figure 11 is a longitudinal sectional view showing a washing machine according to the third embodiment of the present invention.

A washing machine according to the third embodiment of the present invention includes an outer tub 312 disposed in a case, an inner tub 314 installed in the outer tub 312, a hollow dewatering shaft 318 connected to the inner tub 314 and integrally rotated with the inner tub 314, a washing shaft 320 received in the dewatering shaft 318 in such a manner of making an independent rotation to the dewatering shaft 318, a driving motor 322 for providing a driving force to rotate the dewatering shaft 318 and the washing shaft 320, a slanted eccentric shaft 326 installed at the upper part of the washing shaft 320, having a certain interval with a center of the upper part of the washing shaft 320, and formed to be slanted at a certain angle with the central axis of the washing shaft 320, a washing plate 316 installed coaxially with the slanted eccentric shaft 326 and orbiting centering around the washing shaft 320 by the rotation of the washing shaft 320, a counter weight 328 installed at the upper part of the washing shaft 320 at an opposite position to a position at which the eccentric shaft 326 is installed, so as to compensate a lopsidedness of an eccentric weight when the washing plate 316 orbits centering around the washing shaft 320, an upper balancer 324 installed at the upper part of the inner tub 314 and reducing vibration generated during the rotation of the inner tub 314, and a lower balancer 380 installed at the lower part of the inner tub 314 and preventing the lower part of the inner tub 314 from unbalancing by reducing vibration generated during rotation of the inner tub 314.

Herein, the lower balancer 380 has the same construction as described

in the former embodiment of the present invention.

Performance of the washing machine according to the third embodiment of the present invention will now be described.

First, for a washing operation, when a driving force of the driving motor 322 is transmitted to the washing shaft 320, the slanted eccentric shaft 326 installed to be slanted and eccentric with the washing shaft 320 and the counter weight 328 orbit centering around the washing shaft 320. At this time, the washing plate 316 slides on the bottom of the inner tub 314 and rotated centering around the washing shaft 320 to wash the laundry by a continuous agitation. Herein, a random point on the washing shaft 316 vertically moves against the washing shaft 320 according to rotation of the washing shaft 320. At this time, an unbalance of the washing plate 316 due to the eccentric shaft 326 on the basis of the washing shaft 320 is compensated by the counter weight 328 installed at the opposite side of the eccentric shaft 326.

When the washing operation is finished, dewatering is started and water of the outer tub 312 is drained out. That is, when a driving motor 322 is rotated, the dewatering shaft 318 connected to the driving motor 322 is rotated. Then, the inner tub 314 is rotated centering around the dewatering shaft 318 at a high speed by rotation of the dewatering shaft 318, and thus, water contained in the laundry is discharged toward the outer tub 312 by a centrifugal force.

At this time, the inner tub 314 may vibrate because the inner tub 314 is rotated centering around the dewatering shaft 318 at a high speed. However, vibration of the inner tub 314 is prevented by the lower balancer 380 installed at the surface of the lower part of the inner tub 314. Herein, performance of the lower balancer 380 is the same as described in the former embodiment of the

present invention.

In a washing machine according to the third embodiment of the present invention, the balancer is installed at both the upper part and at the lower part of the inner tub to prevent the inner tub from being lopsided during rotation of the inner tub. Therefore, vibration generated during washing and dewatering at a high-speed can be remarkably reduced.

As so far described, in a washing machine according to the present invention, a balancer is installed at an upper part and at a lower part of the inner tub for preventing the inner tub from being lopsided as the inner tub rotates by the rotation of the rotary shaft. Accordingly, vibration generated during washing and dewatering at a high speed can be remarkably reduced.

Particularly, in the case of the vibration type washing machine in which the outer tub, the inner tub, the washing plate and the rotary shaft are not positioned coaxially in second and The third embodiments of the present invention, the inner tub can be lopsided and vibrate easily, but vibration of the inner tub is prevented by installing a lower balancer at a lower part of the inner tub. Therefore performance of the washing machine is improved.

Also, by utilizing a dead volume between the inner tub and the outer tub of the washing machine, water, detergent and time for washing can be saved. Therefore, efficiency of the washing machine can be improved.

As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the

appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.